

ABSTRACT OF THE DISCLOSURE

An inertial ("INS")/GPS receiver includes an INS sub-system which incorporates, into a modified Kalman filter, GPS observables and/or other observables that span previous and current times. The INS filter utilizes the observables to update position information relating to both the current and the previous times, and to propagate the current position, velocity and attitude related information. The GPS observable may be delta phase measurements, and the other observables may be, for example, wheel pick-offs (or counts of wheel revolutions) that are used to calculate along track differences, and so forth. The inclusion of the measurements in the filter together with the current and the previous position related information essentially eliminates the effect of system dynamics from the system model. A position difference can thus be formed that is directly observable by the phase difference or along track difference measured between the previous and current time epochs. Further, the delta phase measurements can be incorporated in the INS filter without having to maintain GPS carrier ambiguity states. The INS sub-system and the GPS sub-system share GPS and INS position and covariance information. The receiver time tags the INS and any other non-GPS measurement data with GPS time, and then uses the INS and GPS filters to produce INS and GPS position information that is synchronized in time. The GPS/INS receiver utilizes GPS position and associated covariance information and the GPS and/or other observables in the updating of the INS filter. The INS filter, in turn, provides updated system error information that is used to propagate inertial current position, velocity and attitude information. Further, the receiver utilizes the inertial position, velocity and covariance information in the GPS filters to speed up GPS satellite signal re-acquisition and associated ambiguity resolution operations

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